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Lin et al.

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(54) **CONNECTOR**

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(22) Filed: **Oct. 8, 2015**

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H01R 13/71 (2006.01)
H01H 13/52 (2006.01)
H01R 13/24 (2006.01)

(52) **U.S. Cl.**
CPC ***H01R 13/2464*** (2013.01); ***H01R 13/2421*** (2013.01)

(58) **Field of Classification Search**
CPC H01R 13/71; H01R 13/2421; H01R 2103/00; H01R 13/7032; H01R 13/70; H01R 13/2428; H01H 13/52; H01H 13/50; H01H 13/12; H01H 1/54; H01H 1/20; H01H 13/14; H01H 13/705
USPC 439/188, 700; 200/534, 250, 341, 521, 200/520
See application file for complete search history.

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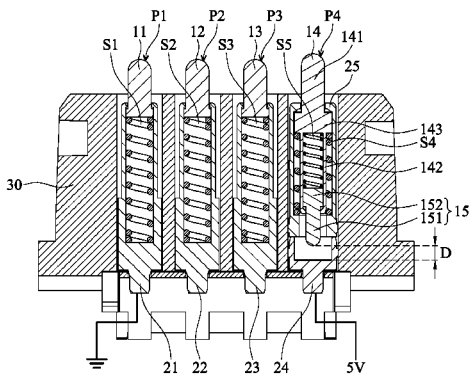
(57) **ABSTRACT**

A connector is provided, including a housing, a conductive contact disposed in the housing, a hollow structure disposed in the housing, and an electrical connecting mechanism. The electrical connecting mechanism is movably disposed in the hollow structure, including a first conductive member, a first spring, a second conductive member, and a second spring. The first spring connects the first conductive member with the hollow structure and provides a first spring force such that the first conductive member protrudes from the hollow structure. The second conductive member and the second spring are movably disposed in the first conductive member, wherein the second spring connects to the first and second conductive members and provides a second spring force such that the second conductive member protrudes from the first conductive member. Specifically, the second conductive member and the conductive contact are spaced apart by a distance. When the first conductive member is pushed by an external force and slides to a predetermined position in a first direction with respect to the hollow structure, the first spring is compressed, and the second conductive member moves in the first direction and contacts the conductive contact.

10 Claims, 7 Drawing Sheets



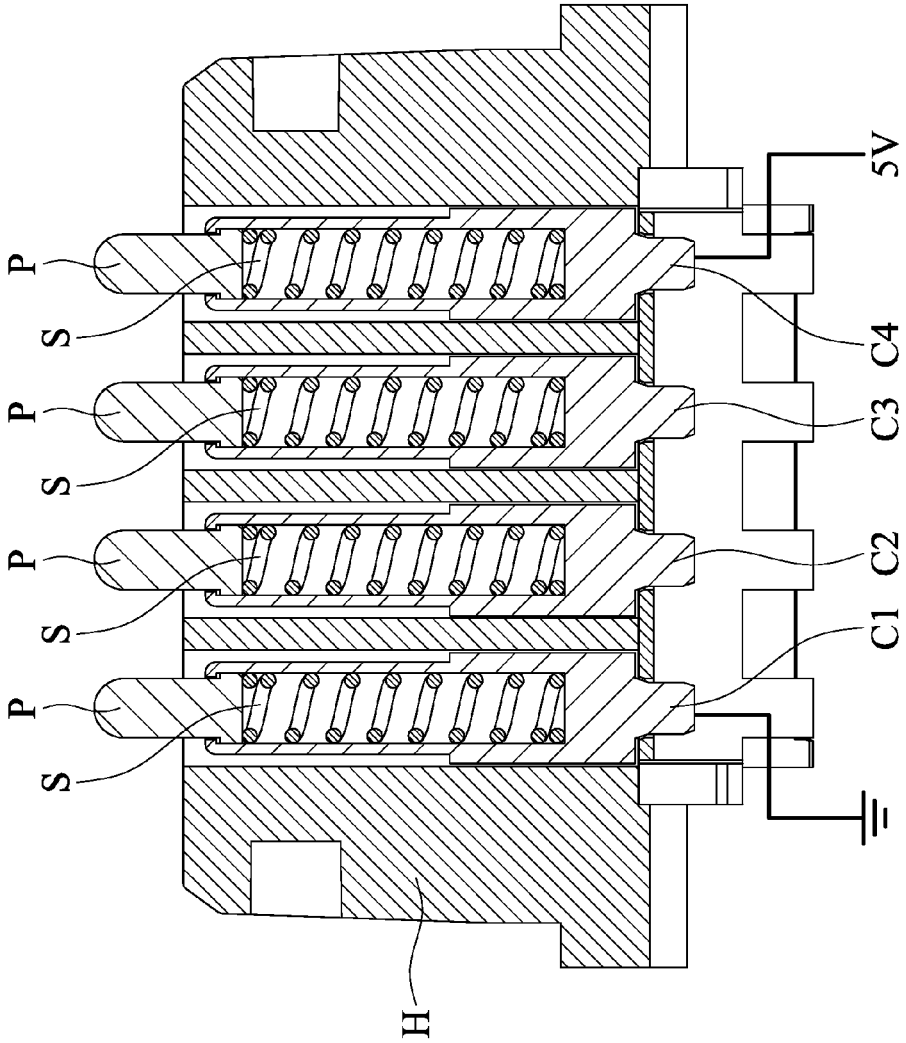


FIG. 1A

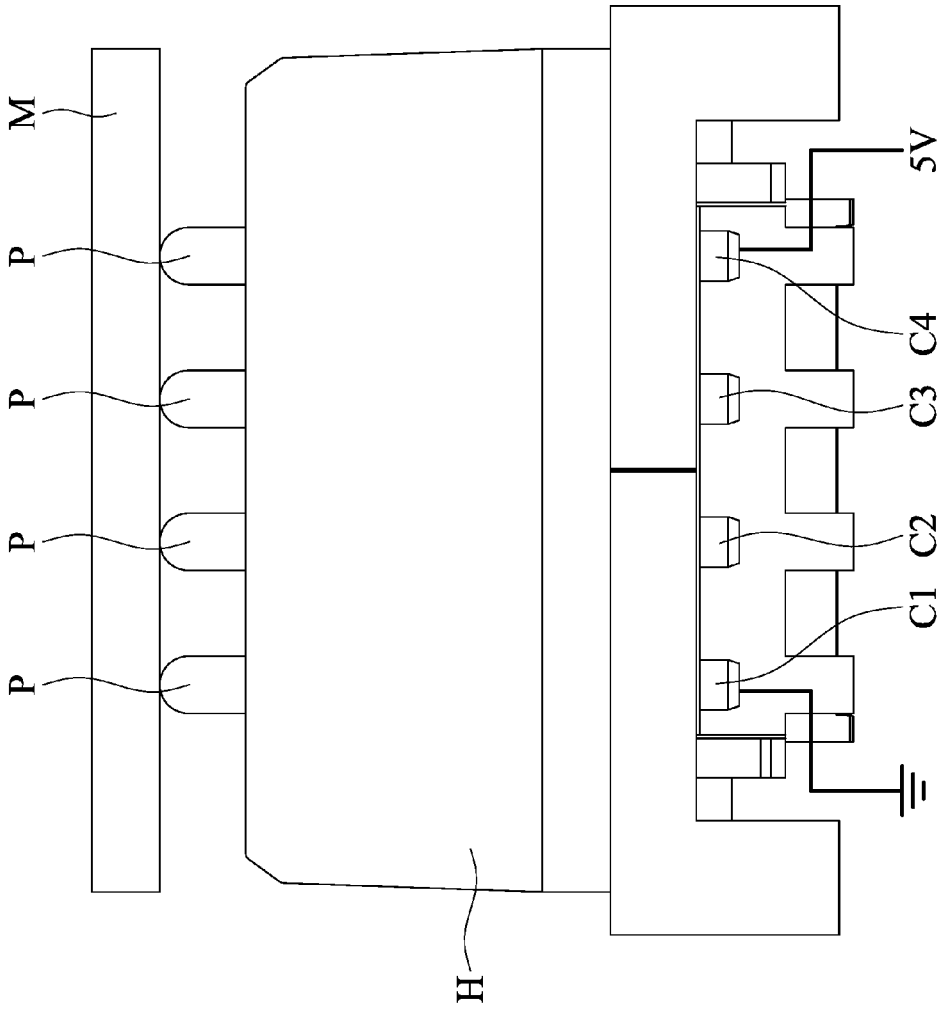


FIG. 1B

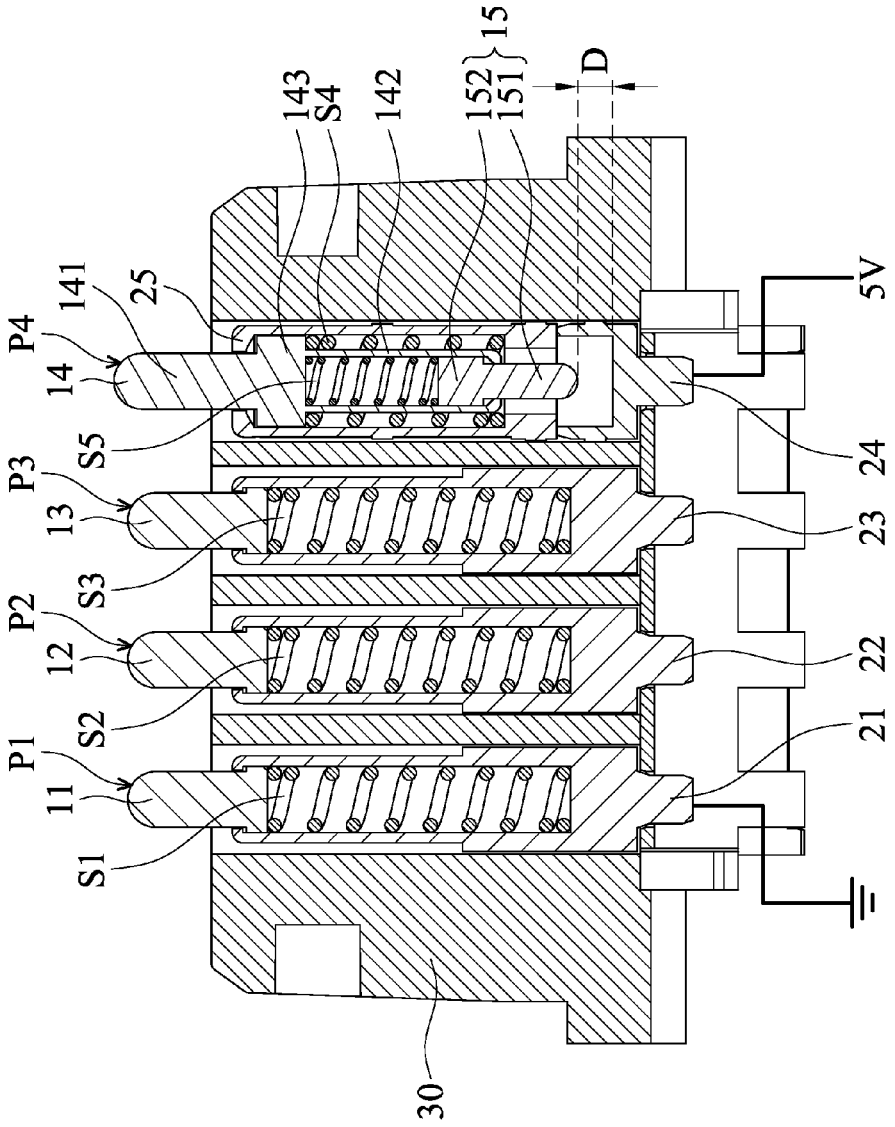

143
S4
142
152
151
15
D
5V
141
25
P4
14
S5
P3
13
S3
P2
12
S2
P1
11
S1
24
23
22
21
30

FIG. 2A

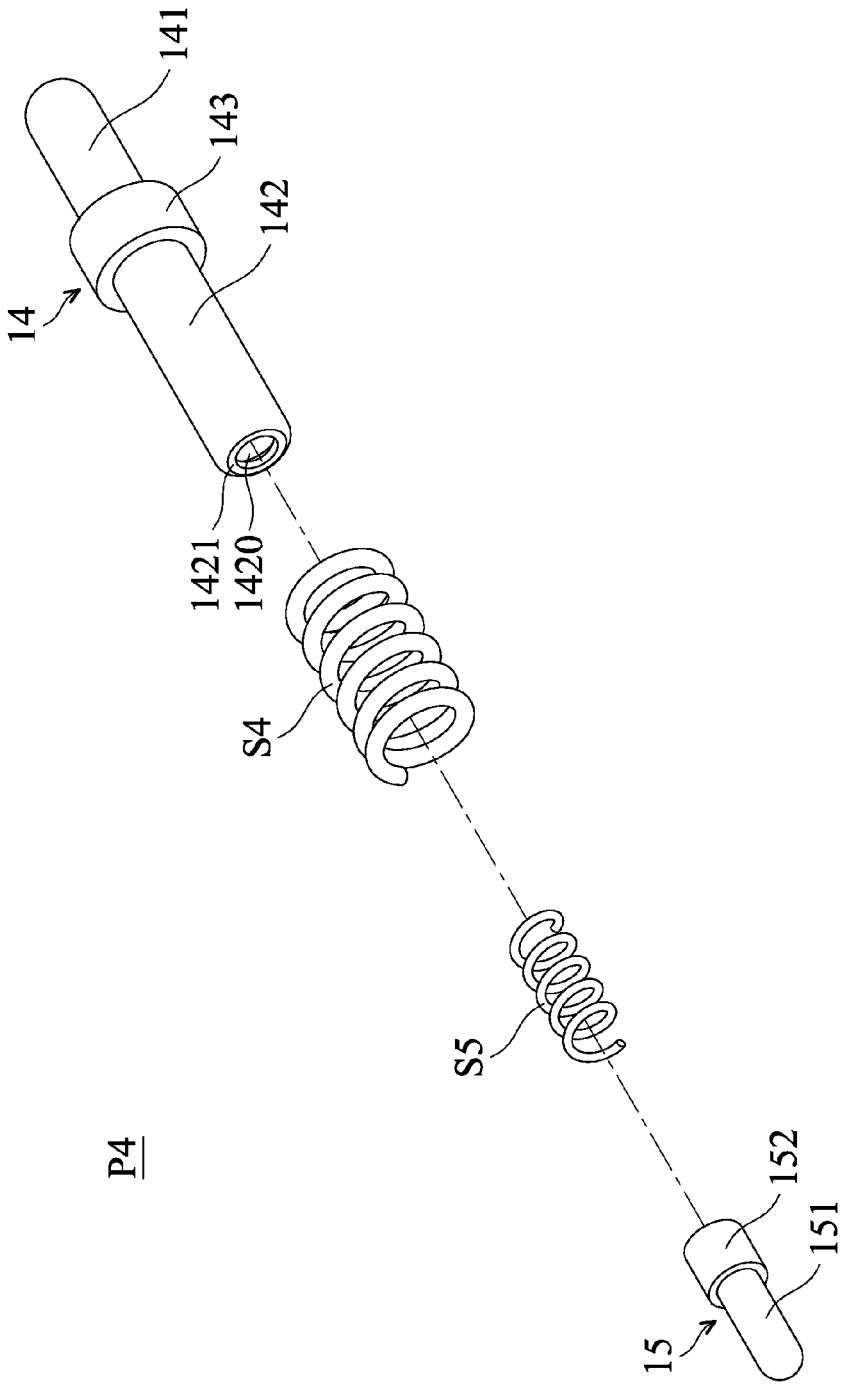


FIG. 2B

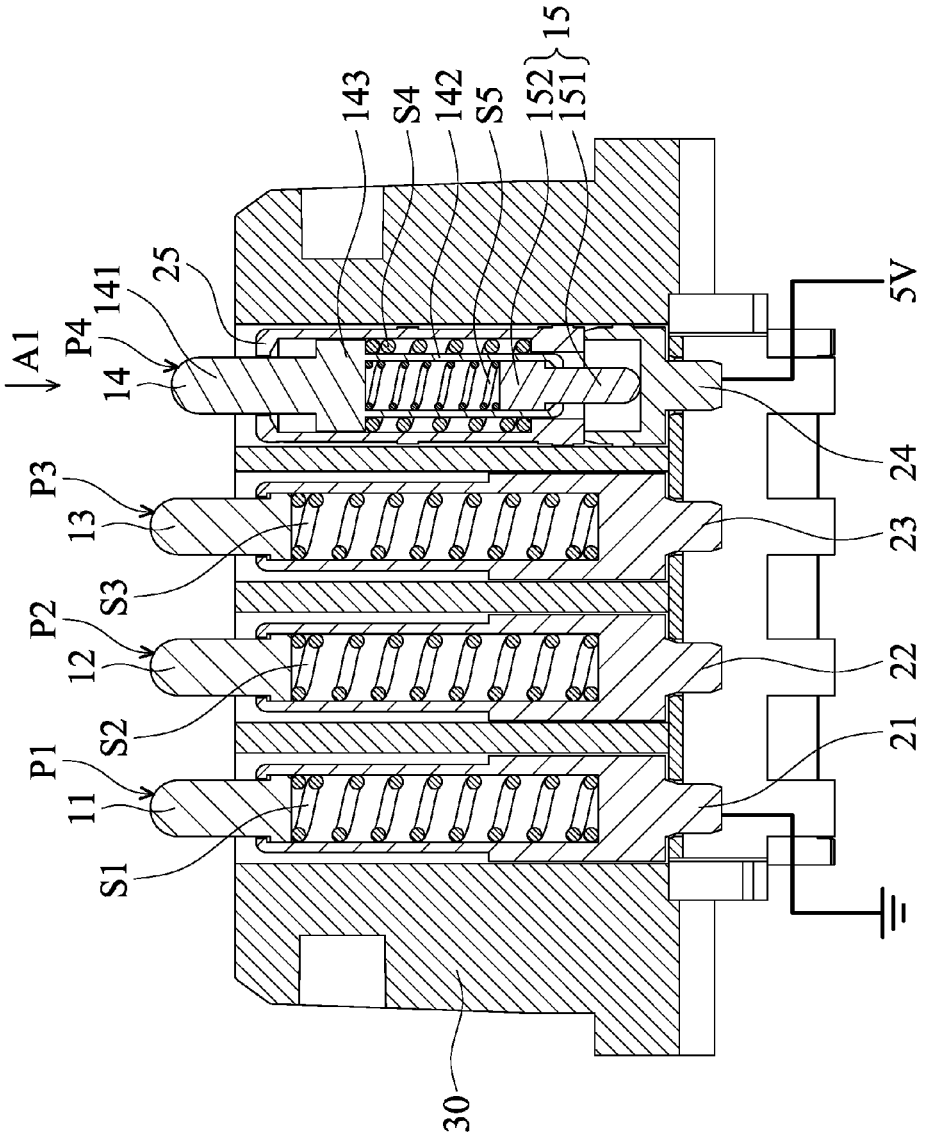
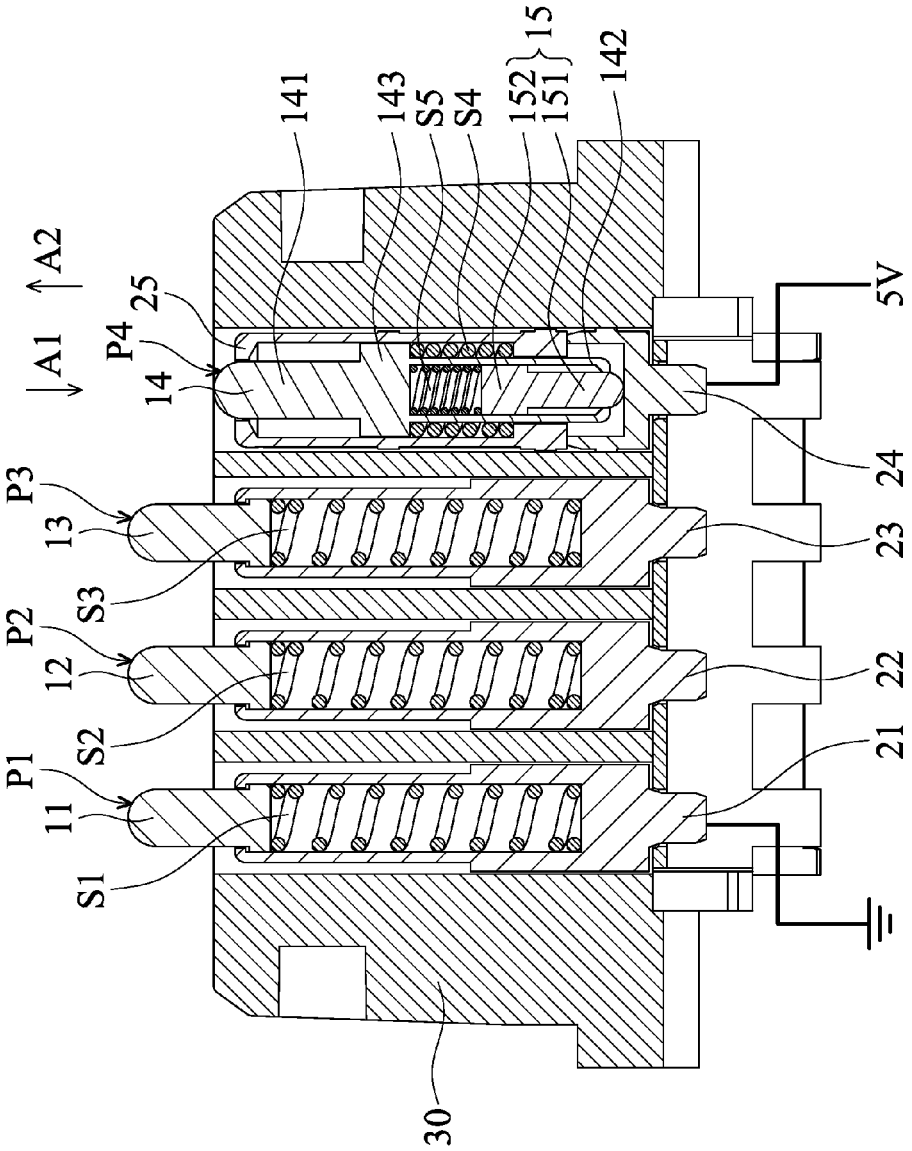

143
S4
142
S5
152
151
15
5V
25
141
P4
14
A1
P3
13
S3
P2
12
S2
P1
11
S1
24
23
22
21
30

FIG. 3A


141
143
S5
S4
152
151
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142
A2
A1
25
P4
14
P3
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S3
P2
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11
S1
5V
24
23
22
21
30

FIG. 3B

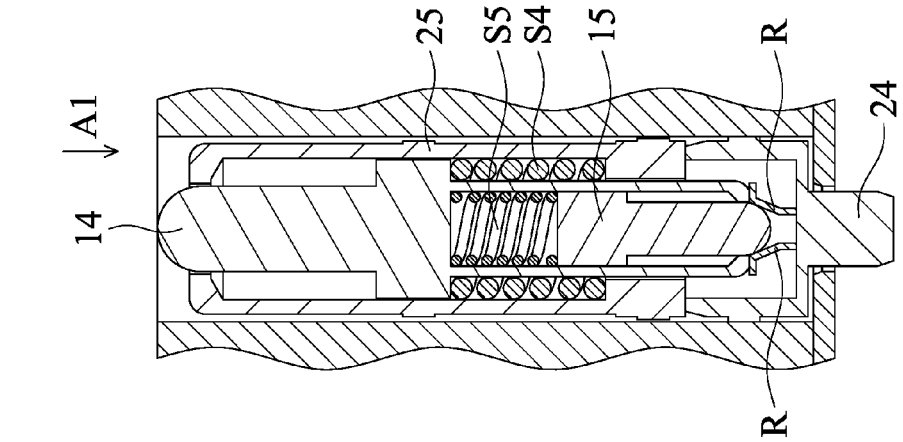

FIG. 4B

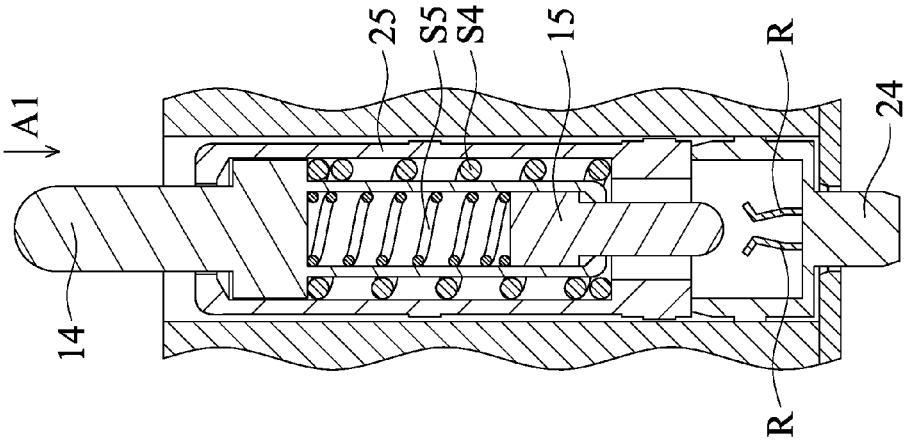

FIG. 4A

CONNECTOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

The application relates in general to a connector, and in particular, to a pogo pin connector.

2. Description of the Related Art

General power chargers for portable or wearable electronic devices usually have a pogo pin connector, as shown in FIGS. **1**A and **1**B, so that the electronic devices can be electrically connected to and charged by the power chargers. Referring to FIG. **1**A, a conventional pogo pin connector primarily comprises a housing H, a plurality of pogo pins P, springs S, and hollow conductive structures C**1**~C**4**. The conductive structures C**1**~C**4** are disposed in the housing H, and the springs S are respectively disposed in the conductive structures C**1**~C**4**. The pogo pins P respectively contact the springs S and electrically connect to the conductive structures C**1**~C**4** in a slidable manner.

As shown in FIG. **1**B, the leftmost and rightmost conductive structures C**1** and C**4** are respectively connected to a ground signal and a power signal (5V). When the four pogo pins P simultaneously contact a metal conductor M, such as a housing of a mobile phone or a metal housing of a pen, a short circuit between the conductive structures C**1** and C**4** may occur and cause a serious spark, thus reducing the safety of usage.

BRIEF SUMMARY OF INVENTION

To address the deficiency of conventional connectors, the invention provides a connector including a housing, a conductive contact disposed in the housing, a hollow structure disposed in the housing, and an electrical connecting mechanism. The electrical connecting mechanism is movably disposed in the hollow structure, including a first conductive member, a first spring, a second conductive member, and a second spring. The first spring connects the first conductive member with the hollow structure and provides a first spring force such that the first conductive member protrudes from the hollow structure. The second conductive member and the second spring are movably disposed in the first conductive member, wherein the second spring connects to the first and second conductive members and provides a second spring force such that the second conductive member protrudes from the first conductive member. Specifically, the second conductive member and the conductive contact are spaced apart by a distance. When the first conductive member is pushed by an external force and slides to a predetermined position in a first direction with respect to the hollow structure, the first spring is compressed, and the second conductive member moves in the first direction and contacts the conductive contact.

BRIEF DESCRIPTION OF DRAWINGS

The invention can be more fully understood by reading the subsequent detailed description and examples with references made to the accompanying drawings, wherein:

FIG. **1**A is a schematic diagram of a conventional pogo pin connector;

FIG. **1**B is a schematic diagram of the pogo pins P in FIG. **1** when in contact with a metal conductor M.

FIG. **2**A is a cross-section view of a connector according to an embodiment of the invention;

FIG. **2**B is an exploded diagram of the electrical connecting mechanism P**4** in FIG. **2**A;

FIG. **3**A is a schematic diagram representing the first conductive member in FIG. **2**A when pushed by an external force and sliding to a predetermined position;

FIG. **3**B is a schematic diagram representing the second conductive member in FIG. **3**A when retracted into the first conductive member; and

FIGS. **4**A and **4**B are partial cross-section views of a connector according to another embodiment of the invention.

DETAILED DESCRIPTION OF INVENTION

The making and using of the embodiments of the connectors are discussed in detail below. It should be appreciated, however, that the embodiments provide many applicable inventive concepts that can be embodied in a wide variety of specific contexts. The specific embodiments discussed are merely illustrative of specific ways to make and use the embodiments, and do not limit the scope of the disclosure.

Unless defined otherwise, all technical and scientific terms used herein have the same meaning as commonly understood to one of ordinary skill in the art to which this invention belongs. It should be appreciated that each term, which is defined in a commonly used dictionary, should be interpreted as having a meaning conforming to the relative skills and the background or the context of the present disclosure, and should not be interpreted by an idealized or overly formal manner unless defined otherwise.

Referring to FIG. **2**A, a connector according to an embodiment of the invention is a pogo pin connector, comprising a housing **30** with three pogo pin units P**1**~P**3** and an electrical connecting mechanism P**4** received therein. The pogo pin units P**1**~P**3** includes three pogo pins **11**~**13**, three hollow conductive structures **21**~**23**, and three springs S**1**~S**3** respectively received in the conductive structures **21**~**23**. The pogo pins **11**~**13** respectively contact the springs S**1**~S**3** and electrically connect to the conductive structures **21**~**23** in a slidable manner. As shown in FIG. **2**A, a hollow member **25** is disposed in the housing **25** with the electrical connecting mechanism P**4** movably received therein. Additionally, a conductive contact **24** is disposed below the hollow member **25**, and the electrical connecting mechanism P**4** is not in contact with the conductive contact **24** before an external force is exerted thereon.

Referring to FIGS. **2**A and **2**B, the electrical connecting mechanism P**4** according to this embodiment primarily comprises a first conductive member **14**, a first spring S**4**, a second conductive member **15**, and a second spring S**5**. In FIG. **2**A, the first spring S**4** is in contact between the inner surfaces of the first conductive member **14** and the hollow member **25**, such that the first conductive member **14** protrudes from the hollow member **25** upwardly by a first spring force of the first spring S**4**. Moreover, the second conductive member **15** and the second spring S**5** are movably disposed in the first conductive member **14**. The second spring S**5** is in contact with the first and second conductive members **14** and **15**, such that the second conductive member **15** protrudes from the first conductive member **14** downwardly by a second spring force of the second spring S**5**.

As shown in FIG. **2**A, when the first conductive member **14** is not pushed by an external force, the second conductive member **15** and the conductive contact **24** are spaced apart by a distance D for electrical insulation therebetween. In this

state, even when the pogo pins **11**~**13** and the first conductive member **14** simultaneously contact a metal conductor, a short circuit between the conductive structure **21** at the leftmost (ground signal) and the conductive contact **24** at the rightmost (power signal) can be avoided, so as to facilitate safety of usage.

In FIGS. **2**A and **2**B, the first conductive member **14** of the electrical connecting mechanism P**4** has a head portion **141**, a hollow rod portion **142**, and a rib portion **143** between the head portion **141** and the rod portion **142**. The rib portion **143** abuts an inner surface of the hollow member **25**, so as to prevent the first conductive member **14** from sliding out of the hollow member **25**, as shown in FIG. **2**A. In this embodiment, the first spring S**4** surrounds the rod portion **142** and abuts the rib portion **143**. When the first conductive member **14** is not pushed by an external force, the head portion **141** of the first conductive member **14** protrudes from the hollow member **25**, and the second conductive member **15** and the second spring S**5** are received in the rod portion **142**.

As shown in FIG. **2**B, the rod portion **142** of the first conductive member **14** has an opening **1420** formed on an end surface **1421** thereof. Additionally, the second conductive member **15** is movably disposed in the rod portion **142**, having a base portion **152** and an extending portion **151** connected to each other. The diameter of the base portion **152** exceeds that of the extending portion **151**, and the extending portion **151** protrudes from the end surface **1421** through the opening **1420**. The base portion **152** is restricted in the rod portion **142** and abuts an inner surface of the rod portion **142**, thereby preventing the second conductive member **15** from sliding out of the first conductive member **14**.

Referring to FIG. **3**A, when the first conductive member **14** is pushed by an external force and slides in a first direction A**1** to a predetermined position with respect to the hollow member **25**, the first conductive member **14** is retracted in the housing **30**. Meanwhile, the first spring S**4** is in a compressed state, and the second conductive member **15** is moved along with the first conductive member **14** in the first direction A**1** to contact the conductive contact **24**. Thus, the first conductive member **14** and the conductive contact **24** are electrically connected through the second conductive member **15**. Referring to FIG. **3**B, when the first conductive member **14** is continuously pushed by the external force and further slides in the first direction A**1** relative to the hollow member **25** from the predetermined position as shown in FIG. **3**A, the second conductive member **15** is stopped by the conductive contact **24** and then retracted into the first conductive member **14** along a second direction A**2**. In this state, the second spring S**5** is compressed, and the second direction A**2** is opposite to the first direction A**1**.

When the external force is released, the compressed first and second springs S**4** and S**5** can return to the state shown in FIG. **2**A by their recovery force, such that the second conductive member **15** is separated from the conductive contact **24**, and the short circuit between the conductive structure **21** (ground signal) and the conductive contact **24** (power signal) owing to unintentional touch can be efficiently prevented.

Referring to FIGS. **4**A and **4**B, the conductive contact **24** according to another embodiment of the invention forms an upwardly extended resilient structure R, such as a metal sheet. When the first conductive member **14** is pushed by an external force and slides in the first direction A**1** relative to the hollow member **25**, as shown in FIG. **4**B, the second conductive member **15** is moved along with the first conductive member **14** to contact the resilient structure R, such that electrical connection between the first conductive member **14** and the conductive contact **24** is achieved. In this embodiment, as the resilient structure R can deform to contact a side surface of the second conductive member **15**, it can be used as a buffer between the electrical connecting mechanism P**4** and the conductive contact **24**, to prevent damages of the connector when an external impact occurs on the electrical connecting mechanism P**4**.

It is noted that the connector throughout the embodiments of the disclosure has at least an electrical connecting mechanism P**4**, and it may further have one or several pogo pin units, such as the pogo pin units P**1**~P**3**, wherein the conductive contact **24** corresponding to the electrical connecting mechanism P**4** may connect to a power signal or a ground signal. In some embodiments, the first and second conductive members **14** and **15** may comprise metal, the hollow member **25** may comprise insulating material such as plastic, and the hollow member **25** and the housing **30** may be integrally formed in one piece.

In summary, the invention provides a pogo pin connector. When a first conductive member in an electrical connecting mechanism is not pushed by an external force, the first conductive member and a conductive contact in the connector are spaced apart by a distance for electrical insulation therebetween. Therefore, even when the first conductive member and the pogo pins simultaneously contact a metal conductor, a short circuit between ground and power signals can be avoided, so as to facilitate safety of usage.

Although some embodiments of the present disclosure and their advantages have been described in detail, it should be understood that various changes, substitutions and alterations can be made herein without departing from the spirit and scope of the disclosure as defined by the appended claims. For example, it will be readily understood by those skilled in the art that many of the features, functions, processes, and materials described herein may be varied while remaining within the scope of the present disclosure. Moreover, the scope of the present application is not intended to be limited to the particular embodiments of the process, machine, manufacture, compositions of matter, means, methods and steps described in the specification. As one of ordinary skill in the art will readily appreciate from the disclosure of the present disclosure, processes, machines, manufacture, compositions of matter, means, methods, or steps, presently existing or later to be developed, that perform substantially the same function or achieve substantially the same result as the corresponding embodiments described herein may be utilized according to the present disclosure. Accordingly, the appended claims are intended to include within their scope such processes, machines, manufacture, compositions of matter, means, methods, or steps. Moreover, the scope of the appended claims should be accorded the broadest interpretation so as to encompass all such modifications and similar arrangements.

Use of ordinal terms such as “first”, “second”, etc., in the claims to modify a claim element does not by itself connote any priority, precedence, or order of one claim element over another or the temporal order in which acts of a method are performed, but are used merely as labels to distinguish one claim element having a certain name from another element having the same name (but for use of the ordinal term) to distinguish the claim elements.

While the invention has been described by way of example and in terms of preferred embodiment, it is to be understood that the invention is not limited thereto. On the

contrary, it is intended to cover various modifications and similar arrangements (as would be apparent to those skilled in the art). Therefore, the scope of the appended claims should be accorded the broadest interpretation to encompass all such modifications and similar arrangements.

What is claimed is:

1. A connector, comprising:

a housing;

a conductive contact, disposed in the housing;

a hollow structure, disposed in the housing; and

an electrical connecting mechanism, movably disposed in the hollow structure, comprising a first conductive member, a first spring, a second conductive member, and a second spring; wherein the first spring connects the first conductive member with the hollow structure and provides a first spring force such that the first conductive member protrudes from the hollow structure; the second conductive member and the second spring are movably disposed in the first conductive member, and the second spring connects to the first and second conductive members and provides a second spring force such that the second conductive member protrudes from the first conductive member;

wherein the second conductive member and the conductive contact are spaced apart by a distance, and when the first conductive member is pushed by an external force and slides in a first direction to a predetermined position with respect to the hollow structure, the first spring is compressed, and the second conductive member moves in the first direction and contacts the conductive contact.

2. The connector as claimed in claim **1**, wherein when the first conductive member is further pushed by the external force and slides from the predetermined position in the first direction with respect to the hollow member, the second conductive member slides with respect to the first conductive member in a second direction opposite to the first direction, and the second spring is compressed.

3. The connector as claimed in claim **1**, wherein the first conductive member has a head portion, a hollow rod portion, and a rib portion; the head portion protrudes from the hollow member, the second conductive member and the second spring are disposed in the rod portion, and the rib portion is disposed between the head and rod portions and abuts the hollow member, so as to prevent the first conductive member from sliding out of the hollow member.

4. The connector as claimed in claim **3**, wherein the first spring surrounds the rod portion and abuts the rib portion.

5. The connector as claimed in claim **3**, wherein the rod portion has an end surface and an opening formed on the end surface, and the second conductive member has a base portion and an extending portion connected to each other, wherein the extending portion protrudes from the end surface through the opening, and the base portion is disposed in the rod portion and abuts an inner surface of the rod portion, so as to prevent the second conductive member from sliding out of the first conductive member.

6. The connector as claimed in claim **1**, wherein the conductive contact is connected to a ground signal or a power signal.

7. The connector as claimed in claim **1**, wherein the connector further comprises at least a pogo pin unit and at least a conductive structure, the conductive structure is disposed in the housing, and the pogo pin unit is electrically connected to the conductive structure.

8. The connector as claimed in claim **7**, wherein the hollow structure comprises insulating material.

9. The connector as claimed in claim **1**, wherein the conductive contact has a resilient structure, and when the first conductive member is pushed by an external force and slides in the first direction relative to the hollow member, the resilient structure deforms and contacts a side surface of the second conductive member.

10. The connector as claimed in claim **9**, wherein the resilient structure comprises a metal sheet.

* * * * *